In the Claims

1. (Currently amended) A method for determining a scene change in a video sequence during encoding of the video sequence, the method comprising:

receiving a first video frame, a second video frame and a third video frame;

determining a first set of motion vectors between the first video frame and the second video frame and a second set of motion vectors using the third video frame; and

comparing a ratio of the first and second sets of motion vectors to a first threshold to determine whether a scene change has occurred, the occurrence of a scene change causing the first frame to be encoded as a different type of frame.

2. (Original) The method of claim 1 wherein the first video frame precedes the second video frame and the second video frame precedes the third video frame.

3. (Original) The method of claim 1 wherein the third video frame precedes the first and second video frames and the second video frame precedes the first video frame.

4. (Original) The method of claim 1, wherein:

the first video frame comprises a first and second field;

the second video frame comprises a first and second field; and

the third video frame comprises a first and second field.

the first set of motion vectors comprises a first subset of motion vectors between the first field of the first video frame and the first field of the second video frame and a second subset of motion vectors between the second field of the first video frame and the second field of the second video frame; and

the second set of motion vectors comprises a first subset of motion vectors between the first field of the second video frame and the first field of the third video frame and a second subset of motion vectors between the second field of the second video frame and the second field of the third video frame.

5. (Original) The method of claim 4, wherein comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the first subset of the first set of motion vectors and the first subset of the second set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the first set of motion vectors and the second subset of the second set of motion vectors to the first threshold; and

determining there is a scene change between the first video frame and second video frame if the first and second ratios are larger than the first threshold.

6. (Original) The method of claim 4, wherein comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the first subset of the first set of motion vectors and the first subset of the second set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the first set of motion vectors and the second subset of the second set of motion vectors to the first threshold; and

determining there is a scene change between the first video frame and second video frame if the first and second ratios are larger than the first threshold and the sum of the magnitudes of members of the first subset of the first set of motion vectors is greater than a second threshold.

7. (Original) The method of claim 4, wherein if second frame is a P-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the first subset of the second set of motion vectors and the first subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the second set of motion vectors and the second subset of the first set of motion vectors to the first threshold; and

determining there is a scene change between the second video frame and third video frame if the first and second ratios are larger than the first threshold.

8. (Original) The method of claim 4, wherein if the second frame is a P-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the first subset of the second set of motion vectors and the first subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the second set of motion vectors and the second subset of the first set of motion vectors to the first threshold; and

determining there is a scene change between the second video frame and third video frame if the first and second ratios are larger than the first threshold and the sum of the magnitudes of members of the first subset of the second set of motion vectors is greater than a second threshold.

9. (Original) The method of claim 1, wherein:

the first video frame comprises a first and second field;

the second video frame comprises a first and second field; and

the third video frame comprises a first and second field.

the first set of motion vectors comprises a first subset of motion vectors between the first field of the first video frame and the first field of the second video frame and a second subset of motion vectors between the second field of the first video frame and the second field of the second video frame; and

the second set of motion vectors comprises a first subset of motion vectors between the first field of the first video frame and the first field of the third video frame and a second subset of motion vectors between the second field of the first video frame and the second field of the third video frame.

10. (Original) The method of claim 9, wherein if the first frame is an I-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the first subset of the first set of motion vectors and a sum of the first subset of the first set of motion vectors minus the second subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the first subset of the second set of motion vectors and the sum of the first subset of the second set of motion vectors minus the second subset of the second set of motion vectors to the first threshold; and

determining there is a scene change between the first video frame and second video frame if the first and second ratios are larger than the first threshold.

11. (Original) The method of claim 9, wherein if the first frame is an I-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the first subset of the first set of motion vectors and the sum of the first subset of the first set of motion vectors minus the second subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the first subset of the second set of motion vectors and the sum of the first subset of the second set of motion vectors minus the second subset of the second set of motion vectors to the first threshold; and

determining there is a scene change between the first and second video frame if the first and second ratios are larger than the first threshold and if the sum of magnitudes of members of the first subset of the first set of motion vectors is greater than a second threshold.

12. (Currently amended) The method of claim 9, wherein if the ~~first~~ second frame is a B-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the ~~second~~ first subset of the ~~first~~ second set of motion vectors and the first subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the second set of motion vectors and the ~~first~~ second subset of the ~~second~~ first set of motion vectors to the first threshold; and

determining there is a scene change between the second video frame and third video frame if the first and second ratios are larger than the first threshold.

13. (Currently amended) The method of claim 9, wherein if the ~~first~~ second frame is a B-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the ~~second~~ first subset of the ~~first~~ second set of motion vectors and the first subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the second set of motion vectors and the ~~first~~ second subset of the ~~second~~ first set of motion vectors to the first threshold; and

determining there is a scene change between the second video frame and third video frame if the first and second ratios are larger than the first threshold and if a sum of members of the ~~second~~ first subset of the ~~first~~ second set of motion vectors is larger than a second threshold.

14. (Currently amended) The method of claim 1, wherein if a scene change is detected further comprising:

beginning a new group of pictures (GOP) ~~can begin~~ at a point after the scene change.

15. (Currently amended) The method of claim 14, wherein if a scene change occurs at a frame following an I-frame further comprising:

converting the I-frame to a P-frame and converting a following P-frame to an I-frame.

16. (Original) The method of claim 1, wherein the threshold is a heuristically determined value.

17. (Currently amended) A video device to encode a video sequence comprising:

an input configured to receive a first video frame, a second video frame, and a third video frame; and

a processor configured to determine a first set of motion vectors between the first video frame and the second video frame and a second set of motion vectors using the

third video frame and compare a ratio of the first and second sets of motion vectors to a first threshold to determine whether a scene change has occurred, the occurrence of a scene change causing the first frame to be encoded as a different type of frame.

18. (Currently amended) The video device of claim 17, wherein:

the first video frame comprises a first and second field;

the second video frame comprises a first and second field; ~~and~~

the third video frame comprises a first and second field[[.]];

the first set of motion vectors comprises a first subset of motion vectors between the first field of the first video frame and the first field of the second video frame and a second subset of motion vectors between the second field of the first video frame and the second field of the second video frame; and

the second set of motion vectors comprises a first subset of motion vectors between the first field of the second video frame and the first field of the third video frame and a second subset of motion vectors between the second field of the second video frame and the second field of the third video frame.

19. (Original) The video device of claim 18 wherein if second frame is a P-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the first subset of the second set of motion vectors and the first subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the second set of motion vectors and the second subset of the first set of motion vectors to the first threshold; and

determining there is a scene change between the second video frame and third video frame if the first and second ratios are larger than the first threshold.

20. (Original) The video device of claim 18, wherein if the second frame is a P-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the first subset of the second set of motion vectors and the first subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the second set of motion vectors and the second subset of the first set of motion vectors to the first threshold; and

determining there is a scene change between the second video frame and third video frame if the first and second ratios are larger than the first threshold and the sum of the magnitudes of members of the first subset of the second set of motion vectors is greater than a second threshold.

21. (Currently amended) The video device of claim 17, wherein:

the first video frame comprises a first and second field;

the second video frame comprises a first and second field; ~~and~~

the third video frame comprises a first and second field[[.]];

the first set of motion vectors comprises a first subset of motion vectors between the first field of the first video frame and the first field of the second video frame and a second subset of motion vectors between the second field of the first video frame and the second field of the second video frame; and

the second set of motion vectors comprises a first subset of motion vectors between the first field of the first video frame and the first field of the third video frame and a second subset of motion vectors between the second field of the first video frame and the second field of the third video frame.

22. (Original) The video device of claim 17, wherein if the first frame is an I-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the first subset of the first set of motion vectors and a sum of the first subset of the first set of motion vectors minus the second subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the first subset of the second set of motion vectors and the sum of the first subset of the second set of motion vectors minus the second subset of the second set of motion vectors to the first threshold; and

determining there is a scene change between the first video frame and second video frame if the first and second ratios are larger than the first threshold.

23. (Original) The video device of claim 17, wherein if the first frame is an I-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the first subset of the first set of motion vectors and the sum of the first subset of the first set of motion vectors minus the second subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the first subset of the second set of motion vectors and the sum of the first subset of the second set of motion vectors minus the second subset of the second set of motion vectors to the first threshold; and

determining there is a scene change between the first and second video frame if the first and second ratios are larger than the first threshold and if the sum of magnitudes of members of the first subset of the first set of motion vectors is greater than a second threshold.

24. (Original) The video device of claim 17, wherein if the first frame is a B-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the second subset of the first set of motion vectors and the first subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the second set of motion vectors and the first subset of the second set of motion vectors to the first threshold; and

determining there is a scene change between the second video frame and third video frame if the first and second ratios are larger than the first threshold.

25. (Original) The video device of claim 17, wherein if the first frame is a B-frame comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the second subset of the first set of motion vectors and the first subset of the first set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the second set of motion vectors and the first subset of the second set of motion vectors to the first threshold; and

determining there is a scene change between the second video frame and third video frame if the first and second ratios are larger than the first threshold and if a sum of members of the second subset of the first set of motion vectors is larger than a second threshold.

26. (Currently amended) A computer readable medium storing executable computer program instructions which, when executed by a processor, cause the processor to perform a method to encode a video sequence comprising:

receiving a first video frame, a second video frame and a third video frame;

determining a first set of motion vectors between the first video frame and the second video frame and a second set of motion vectors using the third video frame; and

comparing a ratio of the first and second sets of motion vectors to a first threshold to determine whether a scene change has occurred, the occurrence of a scene change causing the first frame to be encoded as a different type of frame.

27. (Original) The computer readable medium as set forth in claim 26, wherein the first video frame comprises a first and second field;

the second video frame comprises a first and second field; and

the third video frame comprises a first and second field.

the first set of motion vectors comprises a first subset of motion vectors between the first field of the first video frame and the first field of the second video frame and a second subset of motion vectors between the second field of the first video frame and the second field of the second video frame; and

the second set of motion vectors comprises a first subset of motion vectors between the first field of the second video frame and the first field of the third video frame and a second subset of motion vectors between the second field of the second video frame and the second field of the third video frame.

28. (Original) The computer readable medium as set forth in claim 27, wherein comparing a first ratio of the first subset of the first set of motion vectors and the first subset of the second set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the first set of motion vectors and the second subset of the second set of motion vectors to the first threshold; and

determining there is a scene change between the first video frame and second video frame if the first and second ratios are larger than the first threshold.

29. (Original) The computer readable medium as set forth in claim 27, wherein comparing a ratio of the first and second sets of motion vectors further comprises:

comparing a first ratio of the first subset of the first set of motion vectors and the first subset of the second set of motion vectors to the first threshold;

comparing a second ratio of the second subset of the first set of motion vectors and the second subset of the second set of motion vectors to the first threshold; and determining there is a scene change between the first video frame and second video frame if the first and second ratios are larger than the first threshold and the sum of the magnitudes of members of the first subset of the first set of motion vectors is greater than a second threshold.

30. (New) An apparatus for encoding a video sequence comprising:

means for receiving a first video frame, a second video frame and a third video frame;

means for determining a first set of motion vectors between the first video frame and the second video frame and a second set of motion vectors using the third video frame; and

means for comparing a ratio of the first and second sets of motion vectors to a first threshold to determine whether a scene change has occurred, the occurrence of a scene change causing the first frame to be encoded as a different type of frame.

31. (New) The apparatus of claim 30, wherein if a scene change is detected further comprising:

beginning a new group of pictures (GOP) at a point after the scene change.

32. (New) The apparatus of claim 30, wherein if a scene change occurs at a frame following an I-frame further comprising:

converting the I-frame to a P-frame and converting a following P-frame to an I-frame.